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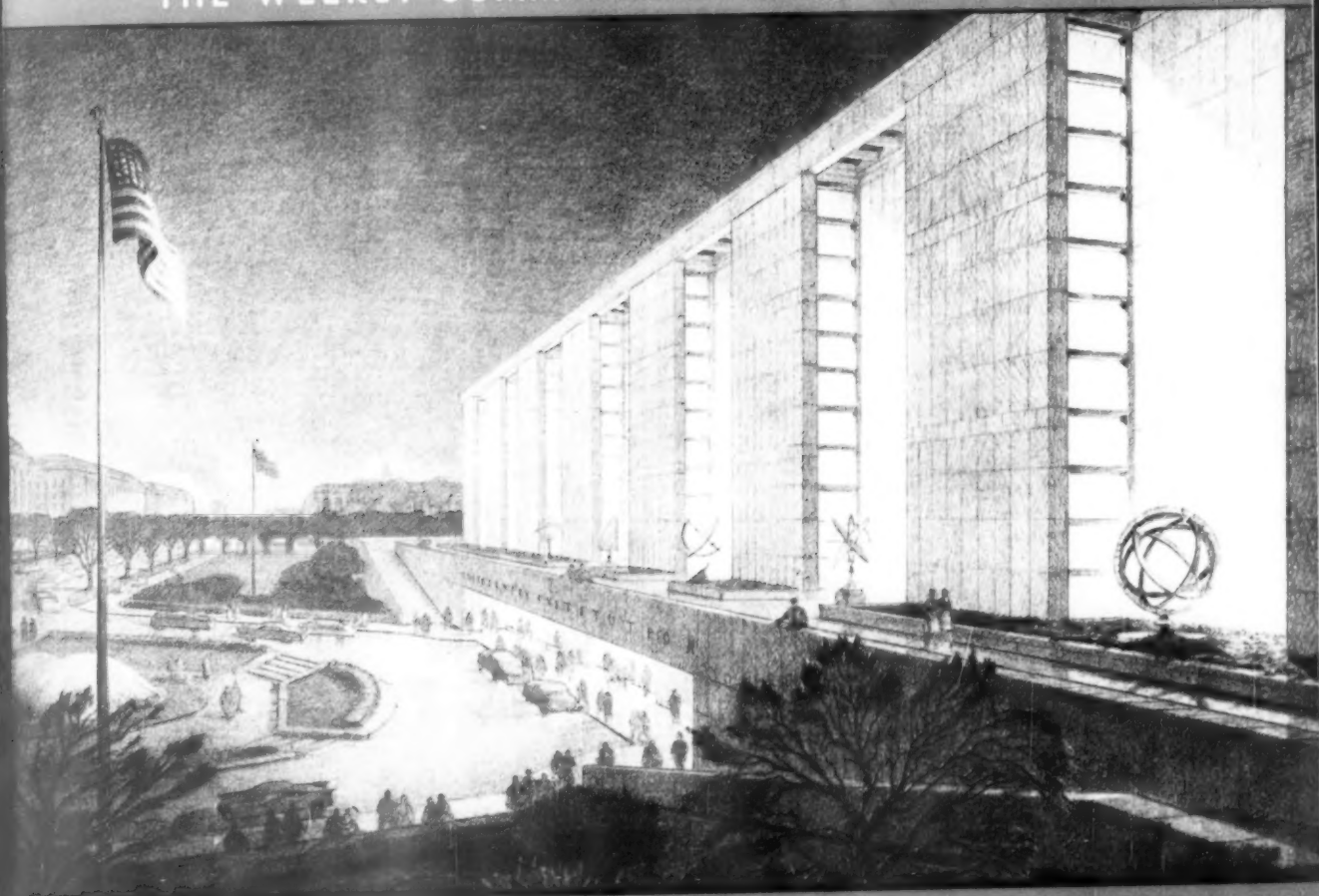
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February 15, 1958

VOL. 73 NO. 7 PAGES 97-112

SCIENCE NEWS LETTER

THE WEEKLY SUMMARY OF CURRENT SCIENCE



National Treasure House

See Page 102

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PHYSICS

Foresee New Particles

Einstein's general theory of relativity is still providing a guide for fruitful research directed at improving our understanding of the physical world.

► MYSTERIOUS particles very unlike those so far found in nature will be discovered if two mathematical models of equations based on the late Prof. Albert Einstein's general theory of relativity prove correct.

Drs. Peter G. Bergmann and Ranier Sachs of Syracuse University reported their analyses of particle models that may be constructed in general relativity to the American Physical Society meeting in New York.

One mathematical model is based on the characteristics that may appear outside the particle on a surface surrounding the particle's location. From this, Drs. Bergmann and Sachs found that not only the expected types of particles could exist but also some mysterious ones not yet detected.

The mysterious particles also were found in a second set of mathematical equations, which analyze particles in terms of the curvature of space-time in the surrounding region.

Drs. E. Newman of the University of Pittsburgh and J. Goldberg of the Aeronautical Research Laboratory, Dayton, reported their completion of a mathematical program so difficult no one had previously carried it out in the 40-year lifetime of general relativity. They related the usual observational data of the astronomer to the individual quantities that can be constructed within the general theory of relativity.

For the first time a complete set of quantities that are independent of the observer and that together characterize uniquely a physical situation in general relativity has been found by Dr. Arthur B. Komar of Syracuse University. Prior to his discovery of the complete set, not even single quantities were known.

Dr. Goldberg also reported on the physical significance of the idea of energy in general relativity. Two Russian scientists, Profs. Landau and Lifshitz, have introduced a new quantity for energy and stress that differs markedly from those used previously. Dr. Goldberg analyzed the relationships between the new and the customary quantities for energy and stress. He found a strong resemblance, but also significant differences not yet completely understood.

These results represent "real progress in disentangling the effects of the state of the observer and his means of description from the objective situation itself," Dr. Bergmann said.

General relativity holds that nature may be described equally correctly with any frame of reference, however curved. The problem is to determine to what extent the selected frame denotes the actual characteristics of the situation itself.

► THE TRACK of a man-made "cascade" particle has been photographed for the first time, Dr. Wilson Powell, University of California physicist, has reported.

All of the known "strange" particles, tiny fragments of sub-atomic matter with fleeting lives, have now been produced and observed in giant atom smashers. Their tracks were also caught in photographic emulsions sent high into the earth's atmosphere to record cosmic rays, mysterious radiation bombarding earth from outer space.

Two "cascade" particles have so far been trapped and photographed in the 30-inch propane bubble chamber placed in the beam of the six-billion-electron volt bevatron, Dr. Powell told the Physical Society.

Cascade particles are the heaviest of the "strange" particles, having a mass 2,539 times the electron and a negative electrical charge. They live for less than a millionth of a second. They were given the name cascade because they decay, or disintegrate, into another heavy particle before finally breaking up again into pi mesons and protons. The psi meson, as the cascade particle is also known, is the only one yet discovered that produces another heavy particle as its first decay product.

The cascade particle studies with the bevatron at University of California Radiation Laboratory were financed by the Atomic Energy Commission.

A previous notable observation with the bubble chamber was the photographing of anti-protons, bits of negative matter. When the protons of ordinary matter come sufficiently close to anti-protons, both particles are annihilated, releasing tremendous amounts of energy.

Science News Letter, February 15, 1958

ASTRONOMY

Survey Shows 86 Stars Have Magnetic Fields

► ELEVEN YEARS of scanning the skies have resulted in discovery of 86 stars definitely known to have magnetic fields.

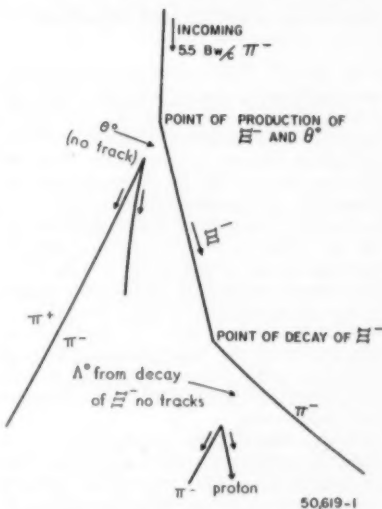
Another 65 stars, self-shining bodies like the sun, are suspected of having magnetic fields by Dr. Horace W. Babcock of Mt. Wilson and Palomar Observatories, Pasadena, Calif. He found the magnetic stars from his studies of their light as photographed with special instruments attached to the 200- and 100-inch telescopes.

All stellar magnetic fields so far observed are variable, Dr. Babcock reports in the *Astrophysical Journal* (Nov. 1957). Most, he has found, vary irregularly, proving that large-scale "hydromagnetic fluctuations occur at the surfaces of these stars."

Of the A-type stars observed, five are

regular magnetic variables having very large and nearly uniform magnetic amplitude and almost symmetrical reversal of polarity; 22 are irregular magnetic variables showing reversal of polarity; and 15 are irregular magnetic variables always showing the same polarity.

Science News Letter, February 15, 1958



CASCADE PARTICLE—The first photograph of a man-made cascade particle is shown along with a diagram (at the top) indicating where the various particles are located. The symbols used include: Ξ^- for the psi or cascade particle; π^- , pi minus; π^+ , pi plus; θ^0 , theta neutral; and Λ^0 , lambda neutral. In identifying the particles in the photograph, first locate the two inverted "V's" at the bottom and near the top left of the diagram.

AERONAUTICS

Space Simulator Built

A research tool that will help the United States considerably in its development of manned satellites and manned travel to the moon has been built.

➤ A SPACE AGE simulator that duplicates in the laboratory the tremendous heats and stresses any vehicle re-entering the earth's atmosphere at great speeds would have to withstand has been built by the National Advisory Committee for Aeronautics at its Ames Laboratory, Moffett Field, Calif.

The new laboratory device is described in the NACA's annual report. Using it, a model about a third of an inch in diameter, weighing five-thousandths of a pound, can simulate the re-entry flight of a full-scale 4,000-mile range missile of three-foot diameter, weighing 5,000 pounds. The atmosphere entry simulator was designed by Dr. Alfred J. Eggers Jr. of Ames Aeronautical Laboratory.

Such research tools are essential to the nation's urgent problem of being the "first to find answers to the formidable questions that now limit the performance of aircraft and missiles," Dr. James H. Doolittle, NACA's chairman, said in a letter submitting the report to President Eisenhower.

The present U. S. program in space research is far from adequate, Dr. Hugh L. Dryden, NACA's director, charged in a speech before the Institute for the Aeronautical Sciences in New York. He said the rate of progress in solving space flight problems "must be very greatly increased." The speech was delivered for him by John F. Victory, NACA executive secretary.

The program's aim would be development of manned satellites and manned travel to the moon and nearby planets.

Instead of naming a new agency to handle the civilian aspects of space flight, Dr. Dryden urged that NACA facilities and staff be expanded. He said the "extremely important non-military aspects of space technology would be submerged or perhaps even lost if included as a mere adjunct to a military program."

NACA would cooperate with the Department of Defense, the National Academy of Sciences and the National Science Foundation, together with universities, research institutions and industrial companies.

The NACA's 17-man "board of directors" has concluded that an adequate program "must enlist the scientific and engineering resources of the nation." The program should include:

1. "Research in space technology to provide data for the design of useful and efficient vehicles and to insure the success of manned space flight operations.

2. "Design and development of scientific and military space vehicles and their launching, flight and recovery.

3. "Research on the phenomena of the high upper atmosphere and nearby space, such as the character and distribution of matter, cosmic rays, solar radiation, electric,

magnetic, and gravitational fields, etc., and scientific studies of the universe made possible by the use of satellites and space platforms as observation sites."

To review the needed research and development, NACA has appointed a Special Committee on Space Technology headed by Dr. H. G. Stever, associate dean of engineering at the Massachusetts Institute of Technology.

Science News Letter, February 15, 1958

PHYSICS

Atmosphere Holds Tons Of Cosmic Dust

➤ THE EARTH'S atmosphere holds more than 28,600,000 tons of suspended dust of cosmic origin below the 60-mile level, Dr. Hans Pettersson of the University of Hawaii reports in *Nature* (Feb. 1).

The dust is extremely fine meteoric particles, which continuously sift slowly earthward.

The entire amount is renewed every two years, which means the earth is picking up at least 14,300,000 tons per year. Added to this is interplanetary dust amounting to about 620,000 tons a year that earth sweeps up in its yearly journey around the sun.

The cosmic dust tonnage is about four times as high as previous estimates, so Dr. Pettersson urges further experiments at other high-altitude observation posts. His samples were obtained by filtering large volumes of air through fine-pored filters at Mauna Loa Observatory on Hawaii at 11,000 feet and from the summit of Mt. Haleakala on Maui, T. H., at 10,000 feet.

The filters were analyzed for iron, nickel and cobalt by Prof. F. Hecht and Dr. E. Tomic of Vienna at the II Chemisches Institut der Universität, Vienna, Austria. The total cosmic dust weight was estimated from the nickel content.

Science News Letter, February 15, 1958

GENERAL SCIENCE

Sputnik Has Its Effect On Congressional Record

➤ SPUTNIK has had its effect on the *Congressional Record*.

Back in pre-sputnik days, the subject science was treated by the *Record* indexers as a stepchild. Today, thanks to sputnik, it has gained its independence and has become an equal of the arts.

It happened this way:

Before January of this year anyone wanting to look up what had been said or published about science in the *Congressional Record* found under the indexed heading

"Science" a little note saying, "see Arts and Science."

Then came sputnik and the space devoted to outer space and other areas of science mushroomed the subject in the *Congressional Record*.

To cope with the new situation, the *Record* indexers at the Government Printing Office decided to divorce "Science" from its role with the "Arts" and make it a separate and distinct heading.

There is still another sign of the times reflected in the index change. Under "Science" is a new note that says, "see also Education."

The old "Arts and Science" is now just "Arts."

Science News Letter, February 15, 1958

SCIENCE NEWS LETTER

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GENERAL SCIENCE

U.S. Weighs Soviet Threat

Scientists, educators and laymen are agreed that the American citizen must be better informed than he now is on the challenge and promise of the scientific revolution.

► THE SPUTNIK-INSPIRED gathering of some 200 scientists, educators and public figures that convened at Yale University assayed the Soviet scientific threat and suggested what should be done about it in the United States.

These possibilities are evident:

America can catch up in science and education, but it will take some doing. It will take dollars as well as brains. Some will argue that we are not behind in all fields, but most will agree there is needed a beefing-up of basic scientific research, more and better teaching at secondary and college levels, and the development of the sense of urgency and importance of science and technology for defense and peaceful living. (See p. 110.)

There was a real apprehension among the gathering that, despite the wide concern about the situation, there is too little appreciation of the necessity of the participation of all the people in the actions that must be taken.

The people do not have the emotional drive of a shooting war, yet those who have worked on the situation realize that the danger right now may be even more acute than it has ever been in the darkest days of any war we have fought.

It is almost as though there were unseen participants in this President's Committee conference on "American human resources

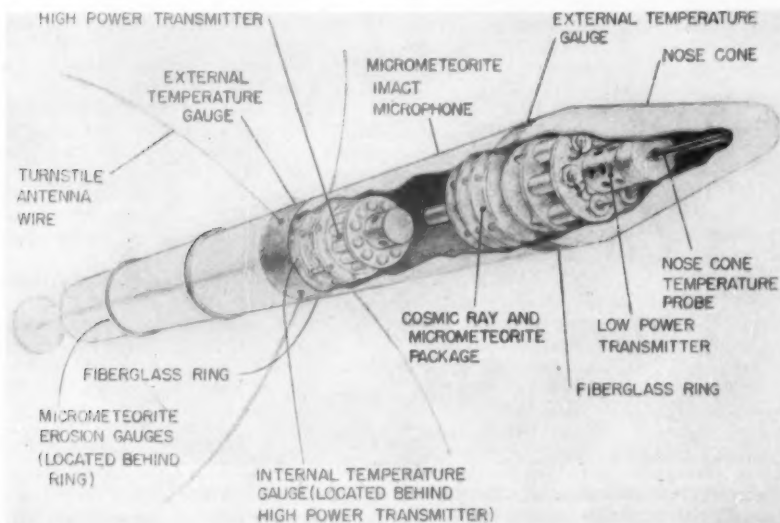
to meet the scientific challenge." These are H-bomb-armed Soviet submarines out in the Atlantic not far away, the many tens of thousands of Soviet students and professors laboring long hours on tough courses of study, and the bosses in the Kremlin who can push-button world destruction.

America's top science "brass" at the conference were led by Dr. James R. Killian, Jr., President Eisenhower's assistant on science and technology, and Dr. Alan T. Waterman, director of the National Science Foundation, while Allen W. Dulles, director of the top-secret Central Intelligence Agency, revealed the total nature of the Soviet threat.

There was insistence by those attending the conference that the public be told the facts, not alone about the Soviet threat, but about:

1. The challenge and promise of the scientific revolution in which we are engaged.
2. The economic benefits of an adequate science program.
3. The importance of technology to the free world and the countries not yet committed to communism.
4. The importance of an educational system that produces well-rounded citizens as it educates the world's best scientists and engineers.

Science News Letter, February 15, 1958



EXPLORER SATELLITE—This cutaway diagram of the first U. S. satellite, the Explorer, now circling the earth some 1,500 miles in the atmosphere, shows in some detail the instrumentation that will give important data on such things as radiation, temperature and meteorite activity of space hundreds of miles out.

● RADIO

Saturday, Feb. 22, 1958, 1:30-1:45 p.m., EST. "Adventures in Science" with Watson Davis, director of Science Service, over the CBS Radio network. Check your local CBS station.

Winners of the Seventeenth Annual Science Talent Search for the Westinghouse Science Scholarships will describe their projects.

Guest portions will be transcribed at CBS San Francisco, Miami, Baltimore, Boston, New York, Philadelphia and Washington.

CHEMISTRY

Basic Research Made "Explorer" Possible

► BASIC RESEARCH that started 150 years ago in Europe is directly responsible for putting America's Explorer satellite into its orbit.

The new, special and "rather exotic" fuel credited by Army missile expert Dr. Wernher von Braun as having powered the Explorer's rocket vehicle is believed to be a modification of one of the new exotic boron-based fuels giving jet aircraft greater speeds, longer range and higher altitude flight.

If Dr. von Braun's use of "exotic" in describing the fuel followed current practice among rocket fuel chemists, the Explorer was powered by a propellant that bears a closer relationship to drugstore eye-wash than to conventional petroleum fuels.

Since the discovery of boron in 1808 by Sir Humphrey Davy in England and, independently, in France by Gay-Lussac and Thenard, the element has found its primary use as a mild antiseptic in the form of boric acid. However, until sometime during World War II, boron was subjected to intensive "pure research" by scientists with no expressed interests in fuels or rockets.

During the century of pure research, volumes of scholarly notes were written about the strange element that seemed partly metallic in character, yet is officially a non-metal. The work, conducted primarily in universities and only for the advancement of scientific knowledge, became the basis of the first detailed American investigation, started in 1942 by Dr. H. I. Schlesinger at the University of Chicago.

Less than ten years ago boron left the basic research laboratory and entered the applied laboratory with a view toward becoming a revolutionary fuel.

The first small production quantities of exotic fuels were delivered to the armed services less than a year ago. As late as December, 1957, scientists queried by SCIENCE SERVICE believed the new high-energy fuels were still available only for jet use and that much more work would be needed to put them in rockets.

However, Callery Chemical Company, Pittsburgh, then announced that one of the fuels, HiCal, had been prepared successfully in a solid form suitable to rockets. Shortly thereafter Callery and Thiokol Chemical Corporation, Trenton, N. J., revealed joint plans to begin early production of solid propellant rocket engines using the exotic fuel.

Science News Letter, February 15, 1958

GEOPHYSICS

Wanted: Moon Photos

Some of the scientific mysteries of the moon might be unraveled if a camera-carrying rocket were successful in reaching the moon and returning to earth.

► SENDING A U. S. rocket to the moon would not only give this country a great propaganda boost in the space race, but it could also have definite scientific value.

Photographs of the moon taken from a rocket zooming close to the lunar surface, then returned to earth, would probably solve the mystery of what caused its craters.

This would be the main scientific value of sending a rocket to the moon and back. Various kinds of paths could be used. If the rocket were launched so that its orbit took it around the dark side of the moon, photographs could be made of the 40% of the lunar surface never visible from earth.

Astronomers would be very surprised if the unseen side looks much different from that seen and mapped from earth. However, because it is unknown territory, scientists would like to have the chance of studying the dark side's features.

Even the world's largest telescope, the famed 200-inch giant atop Mt. Palomar in California, brings the moon only about as close as the naked eye would see it from 200 miles. A camera equipped with telescopic lens carried in a rocket skimming some 50 to 100 miles above the lunar surface could thus get much clearer pictures of the craters and "seas" on the moon than now possible.

It would have the added advantage of not having to photograph these and other features through the earth's atmosphere, continuous changes in which blur images of all heavenly objects, including the man-made earth satellites.

Sunlight reflected from the moon's surface is bright enough so there would be no problem of lighting, even with the ex-

remely short exposures needed because of the rocket's high speed.

Because of the difficulties involved in putting a rocket in an accurate orbit around the moon, and also the problem of recovery, the first lunar trip will probably be a one-way one. The rocket could be equipped with a homing device to insure its hitting the moon.

Some scientists have suggested it should be equipped with a hydrogen-bomb warhead so there would be no doubt when the rocket smashed into the moon's surface.

Probably the ideal way to send a rocket to the moon would be to launch the vehicle as the brightest possible satellite first. Once it is in orbit and its position very accurately known, then the rocket could be sent off on its space journey by signal from earth at the precise moment computed to be the best to set it on a fuel-saving, coasting course to the moon.

When a space vehicle is sent to the moon by just freeing it from earth's gravity, then allowing it to fall freely in space the rest of the way, the journey will take at least five days. It could take longer, depending on which of the various paths were chosen for reaching the moon.

Direct powered flight to the moon from earth would take only about ten hours at speeds of 25,000 miles an hour, which is the velocity necessary to escape from earth's gravitational pull. This kind of journey would require an extremely large fuel supply, while the coasting method would require only that needed to free the rocket from earth's gravitation.

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present form, and for the past three or four billion years the moon has remained unchanged.

Early in the history of both the earth and the moon, conditions permitted escape of nearly all stable gases because there was little or no gravity. During this period, the scientists believe, the earth and the moon were a cloud of meteorites. Earth and moon could retain an atmosphere only after taking their present form.

Because of its size, the earth retains gases as light as nitrogen, oxygen and neon, whereas the moon could only retain the heaviest gases, krypton and xenon.

Only a gas sample taken from the moon will show in what proportions these two gases are present and, therefore, their original source, Dr. Borst said.

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GENERAL SCIENCE

Plans Approved for New Smithsonian Building

See Front Cover

► A MUSEUM big enough to house the Smithsonian Institution's great national collections illustrating the technology and history of the United States will soon be going up in Washington, D. C.

Plans for the new Museum of History and Technology building were announced by Sen. Clinton P. Anderson (D.-N. Mex.), chairman of the joint Congressional committee that has been studying the proposal. The site has already been selected: it is bounded by 12th and 14th streets, and Madison Drive and Constitution Avenue. The building will be modern, but with a "classical spirit" so that it will harmonize with the existing buildings on the nearby Mall and on Constitution Avenue.

The photograph on the cover of this week's SCIENCE NEWS LETTER shows a close-up of the front of the building and the bays which will provide daylight through windows in their narrow faces.

The Smithsonian's unequalled technological collections, many important parts of which have never been displayed before, will be exhibited on the first floor.

Other collections, illustrating the civil and military history and growth of the United States, will be located on the upper floors.

Laboratories and study collections will also be provided for.

The "number one museum item of America," the famous Star Spangled Banner that flew over Fort McHenry in 1814 and inspired Francis Scott Key to write what became our national anthem, will be on display in the centrally located flag hall. This room, the Smithsonian points out, will be a convenient starting point for a museum visitor.

More than 5,000,000 persons are expected to come to the new building each year.

Detailed plans for the arrangement of exhibition halls are now being prepared. Since funds for the construction of the building have been appropriated, it is expected that work will begin on the new museum early this summer.

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PHYSICS

Two Rare Gases on Moon

► WHEN THE FIRST man lands on the moon, the "air" he breathes will contain only two rare, heavy gases, krypton and xenon.

And he will be out of luck if he bought stock in a uranium mine on the moon in hopes of reaping rich profits.

These are the conclusions of Dr. Lyle B. Borst, New York University's physics department chairman, who says he would not buy stock in a lunar uranium mine for himself. After studying possible sources of the moon's tenuous atmosphere, about equivalent to the best vacuum obtained in the laboratory, he concluded there is about one percent as much uranium on the lunar surface as there is on the earth's surface.

Dr. Borst reported his theory, worked out jointly with W. F. Edwards of California

Institute of Technology, at the American Physical Society meeting in New York. Krypton and xenon, which are used to change the color of "neon" lights, are products of the spontaneous fission of uranium-238.

If the uranium on the moon's surface were as great as on the earth's surface, the lunar atmosphere would be much more dense. Recent radio astronomy observations from England show the moon's atmosphere is about one-trillionth as dense as the earth's at the surface.

This atmosphere resulted from the radioactive decay of iodine-129 early in lunar history, the two scientists concluded. According to their theory, it took 400,000,000 years for the moon to be created in its

BIOPHYSICS

Gravity Affects Mice

► **SPACE TRAVEL** will subject living creatures to conditions of high and low gravity vastly different from anything encountered on earth. Two experiments reported to the Biophysical Society meeting in Cambridge, Mass., discussed the effect of simulated high gravity conditions on mice and smaller animals.

Dr. Charles C. Wunder, department of physiology, College of Medicine, State University of Iowa, reported that three-week-old white mice survive being exposed to three and one-half and seven times normal gravitational pull as long as eight days, but their growth is stunted. The artificially high gravity was produced by whirling the mice around in a centrifuge.

Gravity slightly greater than seven times normal produces death within an hour, Dr. Wunder said. The stunting of growth is due mostly to the fact that the high-gravity mice do not eat as much food as mice under normal conditions, he explained. However, when the mice are returned to normal conditions, they continue to develop almost normally. Growth is slowed up most in the mice exposed to seven times normal gravity, but both groups of mice actually lose weight during their first two days in the centrifuge.

The effect of gravity upon the growth of mice, Dr. Wunder said, is more drastic and also more complex than that which has been

reported for simpler forms of life, such as fly larvae.

Speaking at the same meeting, Dr. D. E. Beischer of the U. S. Naval School of Aviation Medicine reported experiments in which animals were immersed in water to protect against the effects of extremely high acceleration forces.

Mice immersed in water and breathing oxygen were able to survive forces 1,500 times normal gravity for half a minute, while small fish survived 10,000 times gravity for the same period of time.

Single-celled animals known as *Euglena* were still alive after the water in which they were suspended was exposed to a force half a million times gravity in an ultracentrifuge for several hours.

Dr. Beischer discussed the limitations of this method for larger animals, including man, and mentioned that the immersion principle can be used to simulate the no-gravity conditions of a satellite in its orbit.

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GEOPHYSICS

Bigger Satellites Will Serve Many Purposes

► **BIGGER** and better earth satellites will soon be serving the world as multi-purpose stations in space.

They will be composite weather, television, telephone and science stations. Later, they will also be stopover points for travel to the moon and the planets.

These are the "earth-satellites-for-peace" uses. There are also potential war uses, such as making a space station as an interplanetary fort for raining missiles down on the earth.

There will be two stages in putting earth satellites to work for man as stations in space. First are the unmanned satellites, such as those now whirling around the earth, which will be followed by larger and more complex vehicles.

The second stage will be manned earth satellites. The first of these will probably carry only one man. From there, however, it will be a short time before teamed satellites will be whirling in space. One way this could be accomplished would be to hurl one man in a rocket into orbit, then he could be joined with others.

Today's satellites are already science stations, collecting information heretofore unknown to man and sending it back to earth. Soon they will be weather stations, also. One planned U. S. satellite is designed to measure the earth's heat balance which will tell weathermen just how much radiation the earth is actually receiving. Future proposals are to chart cloud cover, thus following the movements of great storms, including hurricanes.

These same satellites of tomorrow will serve as television and telephone relay points, whereby programs and conversations will be rebroadcast between New York and Moscow, or any other points on earth.

When man is settled on a satellite he will become an interplanetary astronomer, weatherman, physicist, and builder of space ships. This will give man more information about his environment than all the knowledge he has amassed in his earthbound centuries.

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CHEMISTRY

New Metal-Glass Fiber Makes Plastic Stronger

► **FIBERS** from a new type of glass that partially turns into a metal during production make reinforced plastic structural materials stronger, longer-lasting, the Society of the Plastics Industry, Inc., meeting in Chicago, was told.

The fibers are drawn from glass containing up to 20% copper oxide which is converted to metallic copper when the glass is heated and drawn in an atmosphere of nitrogen gas. Plastics form a tighter bond with copper surfaces than they do with ordinary glass surfaces, J. Frees Brossy, Armand Houze and Albert H. Lasday, Houze Glass Corporation, Pt. Marion, Pa., and James W. Case, Navy Bureau of Ordnance, reported.

The copper-coated glass fibers still are difficult to make and they contain too many imperfections for immediate use, but the scientists believe further work will result in fibers that not only can be used in laminated plastics, but could be used for reinforcing metals as well.

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DECOMPRESSION CHAMBER—A decompression chamber that simulates, for indefinite periods of time, the atmospheric conditions existing at altitude of 18,000 feet has been developed. Dr. Enrique Valdivia, designer of the chamber and instructor in pathology at the University of Wisconsin Medical School, is shown placing a guinea pig in the chamber. John McFee, right, who helped in its building, makes an adjustment in the humidity control apparatus. In six-month study of guinea pigs kept at 18,000 feet, Dr. Valdivia found the animals' right ventricle enlarged greatly.

NEUROLOGY

Brain, Not Air, Makes Vocal Cords Vibrate

► NERVE IMPULSES coming from the brain, rather than air moving in the larynx, make the vocal cords vibrate and produce sound.

Evidence supporting this controversial new theory of human speech has been found by French scientists, Dr. Esti D. Freud, a New York voice teacher, reports in the *Archives of Otolaryngology* (Jan.), published by the American Medical Association.

According to long accepted theory, exhaling air from the windpipe causes the thyroarytenoid muscle to vibrate and thus set up vibrations of the vocal cords.

The French experiments, though, have shown "beyond doubt" that vocal cords vibrate in the absence of an exhaled current of air, and that the vibrations seem to be governed by excitations from a nerve in the larynx or voice box.

This means the exhaled air current cannot be considered the cause of the vibrations of the cords, but only as a sound-carrying medium. The French scientists have also shown that singing and speaking, which produce different vibratory patterns in the vocal cords, originate in different centers of the brain, even though they are both executed by the vocal cords.

This helps explain why persons who stutter or who have lost their ability to speak can still sing without difficulty, Dr. Freud reports.

It also helps explain why a person with a tenor singing voice may speak with a very deep voice.

Dr. Freud is a daughter-in-law of the late Sigmund Freud and is associated with New York Hospital, New York, and a Veterans Administration mental hygiene clinic in Newark, N. J.

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ENGINEERING

Phone Calls and TV To Go Simultaneously

► TELEVISION PROGRAMS and private telephone conversations can be transmitted together over long distances by a single radio relay system now being built in Canada, the American Institute of Electrical Engineers meeting in New York learned.

The "stacking" or "double decking" of telephone and television circuits proved to be "entirely feasible and economically attractive" in tests of a limited number of circuits over ranges of 200 to 1,000 miles, a team of engineers reported.

A system based on the test results will span Canada from Halifax to Victoria as an answer to the problem of providing network TV service as well as long-distance telephone communication to a number of widespread cities requiring only a few circuits to meet their demands.

A series of tests started in 1954 was reported by H. E. Curtis, Bell Telephone Laboratories, New York, and U. C.

Strahlendorf and A. J. Wade, Bell Telephone Company of Canada, Montreal. The first successful experiment was conducted over a 1,134-mile TD-2 radio relay route, using standard television and telephone terminal equipment.

In such an operation, the telephone and TV signals are mixed at the transmitter and unmixed and sent their separate ways at the receiver.

Earlier, the first successful use of "over-the-horizon scatter links" for TV transmission between Miami, Fla., and Havana, Cuba, was described to the meeting.

A TD-2 microwave system is also involved in the Miami-Havana operation reported by K. P. Stiles, F. G. Hollins and E. T. Fruhner, American Telephone and Telegraph Co., New York, and W. D. Siddall, Radio Corporation of Cuba, Havana.

Telephone, as well as television, signals are transmitted, the engineers said.

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METEOROLOGY

Urge Establishment of National Weather Lab

► ESTABLISHMENT of a large national weather laboratory to examine such basic problems as how accurately forecasts can be computed with electronic "brains" has been recommended to President Eisenhower.

The Committee on Meteorology of the National Academy of Sciences has prepared a report strongly urging the need for such facilities, estimating their cost at \$50,000,000. Research in meteorology is at present very restricted by the lack of large-scale equipment to find out, for instance, how raindrops form in clouds, the committee concluded.

Although adequate tools for basic weather research are lacking or limited, nature provides many fascinating clues to her weather mysteries. The bigger and better research instruments that would be available at a national weather laboratory are needed because the scale of weather is world-wide.

For instance, aircraft with precise instrumentation are required to explore the properties of hurricanes in the Caribbean and Atlantic, typhoons in the Pacific, and tornadoes in the great land areas. Aircraft are also required to measure the fueling of the atmospheric heat engine in the equatorial regions and the escape of heat near the poles.

Satellites must be put on patrol to observe continuously the earth's heat balance and small local fluctuations in the balance. They can also chart the formation and movements of large cloud systems.

Design and control of such precisely instrumented aircraft and earth satellites, and analysis and interpretation of the data collected by them require a major and continuing effort. Rain towers, wind tunnels and very fast computers are essential to this effort.

Dr. Lloyd V. Berkner, president of Associated Universities, Inc., which administers Brookhaven National Laboratory, is chairman of the Academy's meteorology committee.

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IN SCIENCE

GEOPHYSICS

Yeast in Satellite Shows Weightless Reproduction

► THE YEAST to be sent circling the earth in one of the U. S. satellites will show whether weightlessness affects its reproduction rate.

The exact variety of yeast to be used has not been revealed, but it will be much like that found in a local grocery store.

To determine the yeast's reproduction rate when weightless in space, scientists will measure the pressure of gas evolving from it, radioed back by code from instruments in the satellite. This pressure will be compared with that from samples of the same yeast culture kept under controlled conditions in a laboratory.

One of the comparison samples will be allowed to multiply at its usual rate. Another sample will be subjected to the same temperature changes and radiations that the satellite yeast is thought to be receiving as well as these conditions can be simulated in the laboratory.

In this way, scientists will be able to determine if being weightless changes the rate of reproduction. They may also be able to determine the effects of the strong radiations in space on growth.

The yeast experiment is a bonus one, and will be done only in the six-inch test spheres sent orbiting around earth by the Navy, according to the present plans. The experiment was chosen because both the yeast and the equipment for containing and measuring the pressure of the gas evolved could be made very lightweight.

Satellites launched by the U. S. in coming years will also carry biological experiments, although only physical ones are now planned for the International Geophysical Year.

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BIOCHEMISTRY

Coal Analysis Points To First Amino Acids

► ANTHRACITE, one of the oldest fossils known, has been analyzed and found to contain three amino acids. This suggests that these amino acids, aspartic acid, glutamic acid and glycine, may have been the first ones formed and the last to decompose in living organisms.

F. Hejkenkjold and H. Mollerberg, department of clinical biochemistry at Karolinska Sjukhuset, Stockholm, Sweden, report finding a "relative proportion" of 12% aspartic and 40% glutamic acids and 48% glycine. It is highly probable, the scientists report, the acids were the original proteins.

Their analysis, reported in *Nature* (Feb. 1), points to the existence of amino acids in fossils 250,000,000 years old.

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CE FIELDS

AGRICULTURE

Atom Agriculture Extends Fruit-Bearing Time

► THE USE of atomic radiations upon plants, one of the major fields of biological investigation detailed in the 23rd semi-annual Atomic Energy Commission Report to Congress, is bearing fruit, literally.

Peach trees that ripen fruit ten days earlier than the stock from which they came are expected to result from a beneficial mutation that has appeared in trees exposed over a long period to gamma radiation in a field at Brookhaven National Laboratory, Long Island, N. Y.

In experiments begun in 1952, the trees were grown in the radioactive fields for one to three years, then returned to normal growth after which they are inspected for beneficial changes in their genes caused by the atomic radiation bombardment.

One branch on a Fairhaven peach tree tested at Rutgers University bears fruit that ripens approximately ten days earlier than the rest.

The radiation effects can also work in the other direction as a branch on a different tree ripens its fruit some three weeks later than normal.

These mutations were first observed in 1956 and confirmed a year later.

Taken together, the two mutations promise to increase by more than a month the season over which the fruit can be available. Buds from these mutations will be grafted on other trees and when enough of the new types are grown they will be tested to see if they are satisfactory for general commercial use.

In other radiation experiments on plants, disease-resistant strains have been obtained in wheat, oats and flax. Dwarf forms with high yields have been observed which should suffer less wind damage than customary strains. Seeds and pollen as well as entire plants are also being radiation treated.

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VIROLOGY

Tumor Viruses in Humans May Be Masked

► THE FAILURE to isolate viruses from human tumors does not rule out the possibility that the tumors are virus-induced.

This has been shown in studies with chickens and turkeys by Drs. Vincent Groupe and Frank J. Rauscher at Rutgers University, New Brunswick, N. J.

Cancers caused by "Rous sarcoma virus" can be induced in chickens or turkeys when the birds are injected with cell-free minces of chicken tumor tissue. The same virus can then be isolated in the chicken tumors but not in turkey tumors.

This phenomenon, Drs. Groupe and Rauscher explained, is called "masking." It suggests that the virus, although present in the turkeys, is either non-infectious or obscured.

The same phenomenon may be taking place in humans. If human cancer viruses exist, the scientists point out, they may follow the same patterns as animal cancer viruses, and are being masked.

The problem of isolating tumor viruses in humans is further complicated by the fact that even known tumor viruses cannot now be recovered in a chicken population in which the incidence of this specific cancer is as low as cancer in humans.

Substances that kill viruses are known to exist in various body tissues and fluids, however, and Drs. Groupe and Rauscher are studying their role as possible inhibitors in the phenomenon of masking.

Their work is being supported by the American Cancer Society, the National Institutes of Health and the Rutgers Research and Educational Foundation.

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MEDICINE

New Research Supports Hope for Cancer Vaccine

► EVIDENCE that a vaccine against human cancer may become a reality sometime in the future was reported by the American Cancer Society.

Dr. Alex B. Novikoff, Albert Einstein College of Medicine, Yeshiva University, New York, has made rats resistant to a transplanted cancer with cell material that, by itself, does not cause cancer.

The work has no practical application to human cancer at present, however.

The antigenic material used, which apparently acts like a vaccine, was extracted from a deadly transplanted tumor that tunnels through tissues, spreads rapidly to distant parts of the body and kills the rat in five to seven days following inoculation. The material was spun out of the cancer cells and comprises less than six percent of their mass.

It completely protected seven of eight animals inoculated with live cancer 14 weeks after injection of the cell material. All "unvaccinated" controls died of cancer on schedule.

The effective cell material is known as the "microsome fraction" of the cancer cells. Microsomes are tiny particles believed to manufacture protein and other cell substances.

The exact chemical nature of the active part of the "vaccine" is unknown.

Several other scientists have "vaccinated" animals against specific cancers, but they usually transplanted whole cancer cells, permitting them to grow for a week or two before removing them and nearby tissues surgically. Only in two cases, both with virus-caused cancers, has partially successful vaccination been achieved by other means.

The research was supported by the American Cancer Society, New York, and the National Cancer Institute, Bethesda, Md.

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ENGINEERING

Heat Pumps Now Work Well in Cold Climates

► HEAT PUMPS, machines that extract and circulate heat from the air, water or ground, are now available for use in very cold climates.

Until recently it was thought that the pumps, which use no conventional fuels and operate in a manner similar to the household refrigerator, would be useful only in moderate or warm climates.

A heat pump providing winter heating and summer air conditioning for homes and businesses in cold climates was described to the American Institute of Electrical Engineers meeting in New York by Robert G. Werden, York Corp., subsidiary of Borg-Warner Corp., Chicago.

The pump is capable of drawing heat from the air, or from water in wells, during 20-degree-below-zero Fahrenheit weather, he said.

No matter how cold the weather may be, the air, ground or unfrozen water, such as in wells and moving streams, still contains considerable heat. This heat is extracted and circulated through buildings in much the same manner as the kitchen refrigerator draws heat from foods and pumps it outside the food storage area.

Most heat pumps, including the one described by Mr. Werden, can be reversed to act as air conditioners during warm weather.

Although they burn no coal, oil or gas, heat pumps, like refrigerators, do require electricity to keep the heat-carrying air or gas in circulation.

The new heat pump operates best in extraction of heat from water, Mr. Werden said, but also is available in an air extraction model.

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PHYSICS

Vibration Makes Symmetrical Snow Flakes

► VIBRATION is the secret of how each arm of a snow flake or crystal "knows" what the others are doing and duplicates their pattern.

S. Tolansky of Royal Holloway College, Surrey, England, explains the remarkable symmetry of a six-ray, star-shaped snow flake as the result of each flake's vibrating mechanically as a flat plate.

Water vapor molecules are constantly bombarding a snow flake and are less likely to stick to parts that are in "violent motion." Where the molecules do adhere they exert a damping effect on the vibrations, slowing them down, and more molecules tend to collect in the same spot.

Each arm of the snow flake feels the damping effect at the same time. This means, the scientist reports in *Nature* (Jan. 25), that growth is symmetrical since water molecules collect on each arm in identical places.

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SURGERY

Man-Made Hands

Today's artificial hand looks and feels like the real thing. Now what remains is to connect it to the nervous system, giving metal and plastic the sense of touch.

By JOHN W. ROBINSON

► ON FILE with the Federal Bureau of Investigation in Washington, D. C., are two sets of the most unusual fingerprints in the world. They match perfectly with those of thousands of American amputees yet they actually belong to only two men.

The prints were donated by two specialists in the design and development of artificial hands, and have been molded into a plastic-like "cosmetic glove." This glove covers many of the mechanical hands of both military and civilian amputees.

The glove is complete with hair and fingernails and is so lifelike that it is almost startling to see when detached. It is one of the latest developments from the Army Prosthetics Research Laboratory at Forest Glen, Md.

The laboratory was set up after the Second World War to carry on the research and development of artificial parts of the body for both the armed forces and the artificial limb industry.

"Making an artificial hand is much more complicated than it might first appear," Col. Maurice Fletcher, director of the Laboratory, explains.

For years, the first thought of artificial hand makers has been to make the hands fully articulated, so that each joint could move just like the normal hand. Many of the early hands were full of pulleys, wires and other mechanical parts.

One such hand was made in Ireland in the late 1600's and is quite an impressive piece of design and craftsmanship. The only trouble with it was that it took three people to operate it.

Streamlined Hand

Today's artificial hand has been streamlined so that it can be operated with a single control cable and is even a few ounces lighter than a normal hand.

A big problem is standardizing the experimental hand so that it will fit the greatest number of amputees and give them all maximum usage. There are 25 separate muscle groups in the human hand and no two people use them in exactly the same way, even when performing the same task.

The standard hand in use today is known as the APRL hand. It came out of the Laboratory and into production in 1948. It has kept only the most essential movement, that of prehension. This basic finger movement is one of the main distinctions between man and his animal relatives.

Prehension is accomplished by bringing the thumb, forefinger and middle finger together at the tips, and accomplishes about

60% of all the jobs that a hand performs. Most of the time, the other fingers on the normal hand are just dead weight, so in the artificial hand they have been molded on in a set position, are flexible, and curve slightly toward the palm.

The angle of this curve is one of the many small but important details in the design of the hand. The angle has been calculated so that when the hand closes on an object, the fingers will not eject it outward but rather force it back inside the hand.

The hand is operated by a single cable which can either open or close the fingers when it is pulled. A spring mechanism inside serves to return the fingers to their original position.

The muscle power for the hand obviously has to come from another part of the body and several methods are in use for supplying this force to the artificial part. Some amputees have a shoulder strap which is attached to the hand by a cable. They can then operate the fingers by slightly twisting their shoulders or pushing their arm forward.



LIFELIKE PAINT JOB—After being painted with normal skin tones, these plastic-like "cosmetic gloves" will be pulled over artificial hands developed at the Army Prosthetics Research Laboratory, Forest Glen, Md. The gloves are detail-perfect down to the fingerprints and have the texture of human skin.

Another method which is becoming more fully developed each year is known as cineplasty. This requires the expert cooperation of the surgeon who does the amputation since it involves harnessing the muscles near the stump of the limb so that they can be used for power.

The surgeon constructs a muscle tunnel in such a way that a plastic peg can be inserted through the tunnel from one side to the other. Cables are then attached to the peg on each side so that flexing the muscle tightens the main cable and the fingers move.

Efficiency Needed

An important characteristic of any artificial hand is its efficiency, that is, the amount of work you get out of the hand for the amount put in.

Poor efficiency was one of the main drawbacks in the earlier and more complicated hands. In completely articulated experimental hands at the Laboratory, the efficiency was never much over seven percent. This resulted in so much power being applied to the hands that they usually broke under the strain. The APRL hand has been designed so that it gives approximately 80% efficiency.

Earlier hand models also had a position-locking mechanism on the side which the wearer would have to set with his other hand. This was eventually discarded too, since the whole object of the artificial hand was to make the amputee "bilateral" again, and not to tie up even his good hand with control functions.

Today's artificial hand is good, but it still lacks one of the human hand's most basic abilities, that of being able to feel.

"Putting feeling into a lifeless hand is probably the biggest problem yet to be solved," Col. Fletcher believes.

Not only is the sense of touch needed, but also the feeling of pressure and of knowing the position of the hand and fingers without looking.

A variety of electrical and mechanical gadgets have been designed to solve this problem, but even though they work out in the laboratory, putting them into actual use is another matter.

Putting "Life" into the Hand

A hydrostatic method was tried using two small air-filled balloons connected by a thin tube. One balloon was attached to one of the fingers of the hand and the other was attached somewhere on the wearer's chest. Pressure on the finger balloon would then cause pressure on the chest.

Several of these balloon groups were tried together, one on each finger and the others spaced around the chest. But it became too confusing to the wearer to relate the slight "touch" on one part of his chest with pressure on a certain finger.

"We have to be careful not to exceed the 'hardware tolerance' of the amputee with all these gadgets, or he will just decide to throw them away," Col. Fletcher said.

Another method involved the use of electric buzzers of different frequencies to signal contact with the various fingers. This, too, worked much better in the Laboratory than it did on an amputee.

Future developments may center around stimulating the nerves directly, at some level between the lost limb and the brain. Neurosurgeons can already isolate nerve fibers in the arm which travel down to the finger tips, but getting them stimulated in the correct way is the problem.

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SURGERY

Titanium Finger Joint Can Save Amputation

➤ A HINGED titanium finger joint that promises to prevent amputation of the finger in many cases was described to the American Society for Surgery of the Hand meeting in New York.

The device has been used successfully in 14 patients, Lt. Col. Earl W. Brannon, chief of the orthopedic service at Lackland Air Force Base Hospital, said.

The hinged titanium prosthesis, designed to replace irreparably damaged finger joints, is a replica of the normal joint and replaces the entire joint. To date, it has been used only in the small joints of the finger.

It is locked in place by a half-threaded rivet screw. Each section has a triangular stem to be inserted in the finger bones, which keeps the metal joint from rotating. The hinged joint portion is finely bevelled and smoothed to prevent catching or irritating adjacent tissues by its movement.

Various sizes, Dr. Brannon said, now are made for various fingers and for persons of different size hands.

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AGRICULTURE

Certified Seed Insures Superior Alfalfa Crop

➤ FOR MAXIMUM benefits from improved varieties of alfalfa, a farmer should be sure to use certified seed.

Dr. Karl Quisenberry, assistant administrator of the U. S. Department of Agriculture's Agricultural Research Service, warns that appearance alone will not show if seed has the improved qualities built into it by plant breeders.

A farmer who purchases and plants seed of "non-certified Ranger," for example, has less than a 50% chance of getting seed of Ranger performance, he said.

A further problem in planting non-certified seed is that especially bred qualities, such as high yield and winter hardiness, may be lost when the variety of grass or legume seed has not been produced, harvested and processed under properly controlled conditions.

Science News Letter, February 15, 1958

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Books of the Week

For the editorial information of our readers, books received for review since last week's issue are listed. For convenient purchase of any U. S. book in print, send a remittance to cover retail price (postage will be paid) to Book Department, Science Service, 1719 N Street, N.W., Washington 6, D. C. Request free publications direct from publisher, not from Science Service.

AMINO ACID CONTENT OF FOODS—M. L. Ott and B. K. Watt—Govt. Printing Office, U.S.D.A. Home Economics Research Report No. 4, 82 p., paper, 45¢. The quality of a protein is related to the kinds and quantities of amino acids it contains.

ATOMIC ENERGY IN AGRICULTURE—William E. Dick—Philosophical Lib., 150 p., illus., \$6. Atomic energy can be used to destroy and control pests and diseases, and may be used for wholesale preservation of foods and pharmaceutical compounds.

ATOMIC ENERGY IN MEDICINE—K. E. Halnan—Philosophical Lib., 157 p., illus., \$6. An introduction to a new field of science.

ATOMS, ENERGY AND MACHINES—Jack McCormick—Creative Educ. in cooperation with the Am. Mus. of Natural Hist., 224 p., illus., \$4.95. Directed to the general reader, this book gives insight into everyday physics.

BASIC CONCEPTS OF PHYSICS: The Five Great Theories—Chalmers William Sherwin—Dryden, Preliminary ed., 281 p., illus., paper, \$4.74. Covering classical mechanics, electricity, quantum mechanics, statistical mechanics and relativity.

BETTER REPORT WRITING—Willis H. Waldo—Reinhold, 231 p., illus., \$4.75. A small reference guide on preparation of technical literature for the modern scientist.

CALCULUS—Edward S. Smith, Meyer Salkover and Howard K. Justice—Wiley, 2nd ed., 520 p., illus., \$6.50. A revised edition of a first course textbook originally published in 1938.

CAMERA LENSES: A Handbook to Lenses and Accessories for Amateur and Professional Photographers—Arthur Lockett, rev. by H. W. Lee—Pitman, 4th ed., 146 p., illus., \$3.25.

CHECK-LIST OF NORTH AMERICAN BIRDS—Prepared by a Committee of the American Ornithologists' Union, Alexander Wetmore, Chairman—Am. Ornithologists' Union, 5th ed., 691 p., \$8. Covers the progress of a quarter century in North American ornithology.

THE CHEMICAL DYNAMICS OF BONE MINERAL—William F. Neuman and Margaret W. Neuman—Univ. of Chicago Press, 209 p., illus., \$5. The purpose of this monograph, according to the authors, is to stimulate interest and research.

CHRONIC ILLNESS IN A LARGE CITY: The Baltimore Study—Commission on Chronic Illness, Dean W. Roberts, Dir.—Harvard Univ. Press for the Commonwealth Fund, 620 p., \$8. Fourth in a series of exhaustive studies of chronic illness in the U. S.

THE DAWN OF LIFE—J. H. Rush—Hanover House, 262 p., \$4.50. The physicist-astronomer explains here in readable fashion the theory how life can develop out of non-living material wherever suitable conditions prevail for a sufficient time.

DISCOVERY OF THE POLES—Quintin Riley and Richard Taylor—Puffin Picture Book (Penguin), 30 p., illus., paper, 85¢. For children and grownups, full of interesting facts about Arctic and Antarctic worlds.

THE EARTH'S STORY—Gerald Ames and Rose Wylar—Creative Educ. in cooperation with the Am. Mus. of Natural Hist., 222 p., illus., \$4.95. More photographs than text, this book gives the lively story of the ever-changing land and its inhabitants.

ECONOMICS OF ATOMIC ENERGY—Mary Goldring—Philosophical Lib., 179 p., illus., \$6. On the impact of nuclear power as an industrial force in Great Britain.

ELECTRICAL DISCHARGES IN GASES—F. M. Penning, translated from Dutch by A. F. Monypenny—Macmillan, 75 p., illus., \$3. Concise synopsis of a field of physics of importance to the engineer.

EMULSIONS: Theory and Practice—Paul Becher—Reinhold, 382 p., illus., \$12.50. Gives particular attention to the developments in this field in the last fifteen years.

EXPERIMENTAL LIGHT AIRCRAFT AND MIDGET RACERS—John Underwood and John Caler—Aero Publishers, 72 p., illus., paper, \$2.50. Includes foreign airplanes.

FALL FLOWERS—Verne N. Rockcastle—N. Y. State College of Agric., Cornell Rural School Leaflet Vol. 51, No. 2, 32 p., illus., paper, 20¢. Describes for young people the make-up of flowers found in the fall of the year.

FORTY-THIRD ANNUAL REPORT OF THE NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS 1957: Administrative Report Without Technical Reports—James H. Doolittle, Chairman—Govt. Printing Office, 80 p., illus., paper, 75¢.

Fossil Men—Marcellin Boule and Henri V. Vallois, translated from the French by Michael Bullock—Dryden, 535 p., illus., \$9.50. Summarizes man's knowledge of his origin and the earliest history of his kind.

GEOGRAPHY IN THE TWENTIETH CENTURY: A Study of Growth, Fields, Techniques, Aims and Trends—Griffith Taylor, Ed.—Philosophical Lib., 3rd ed., 674 p., illus., \$10. The editor describes geography as "the discussion of the causes of patterns of distribution."

HUMAN ENGINEERING—Ernest J. McCormick—McGraw-Hill, 467 p., illus., \$8. An introductory text on the design of equipment and the adaptation of work environments for optimum human use.

AN ILLUSTRATED GUIDE TO COMMON ROCKS AND ROCK FORMING MINERALS—David Allan and Vinson Brown—Naturegraph, 32 p., illus., with drawings and color photographs, paper, 35¢. Gives basic ground work for understanding and identifying common rocks.

THE INVERTEBRATA: A Manual for the Use of Students—L. A. Borradaile and F. A. Potts, with chapters by L. E. S. Eastham and J. T. Saunders, rev. by G. A. Kerkut—Cambridge Univ. Press, 3rd ed., 795 p., illus., \$8.50. A text book brought up-to-date.

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LABORATORY DIRECTIONS IN GENERAL ZOOLOGY—Mary J. Guthrie and John M. Anderson—Wiley, 233 p., illus., paper, \$3.50.

THE LIFE OF MAMMALS—J. Z. Young—Oxford Univ. Press, 820 p., illus., \$10. This textbook treats the subject conventionally, yet shows how new approaches can be incorporated.

MARCH'S THESAURUS-DICTIONARY—Francis Andrew March and Francis A. March, Jr., introduction by Clarence L. Barnhart. Norman Cousins, Ed., New Supplement by R. A. Goodwin—Hanover House, 1240 p., \$9.75, thumb indexed \$10.75. This new edition replaces March's which went out of print during World War II.

NEURITIS, SENSORY NEURITIS, NEURALGIA: A Clinical Study With Review of the Literature—Robert Wartenberg, foreword by Wilfred Harris—Oxford Univ. Press, 444 p., illus., \$8.50. A clinical work by a practicing neurologist.

NUCLEAR MASSES AND THEIR DETERMINATION: Proceedings of the Conference Held in "Max-Planck-Institut für Chemie"—H. Hintenberger, Ed.—Pergamon, 267 p., illus., \$14. This conference was held at Mainz in July 1956.

OFFERINGS AND ENROLLMENTS IN SCIENCE AND MATHEMATICS IN PUBLIC HIGH SCHOOLS—Kenneth E. Brown and Ellsworth S. Obourn, assisted by Marguerite Klutz—Govt. Printing Office, U. S. Dept. of Health, Education and Welfare, Pamphlet No. 120, 44 p., illus., paper, 25¢.

POLYURETHANES—Bernard A. Dombrow—Reinhold, 176 p., illus., \$4.50. A semi-technical treatise of the properties and correct application of this family of plastics.

THE PSYCHOLOGY OF PERSONAL ADJUSTMENT—Roger W. Heyns—Dryden, 548 p., \$4.90. An attempt to apply the results of research in psychology, sociology and cultural anthropology to our problems of adjusting in a complex world.

SATELLITES AND SPACEFLIGHT—Eric Burgess—Macmillan, 159 p., illus., \$3.95. Shows how the earth satellite program grew out of developments in military rockets and how it can lead to interplanetary probe missiles.

THE SPECTRUM OF ATOMIC HYDROGEN—G. W. Series—Oxford Univ. Press, 88 p., illus., paper, \$2. Since hydrogen is the simplest kind of atom, the interpretation of its spectrum has been of the greatest interest to theorists.

TREATISE ON MARINE ECOLOGY AND PALEOECOLOGY: Vol. 1, Ecology—Joel W. Hedgpeth, Ed.—Geological Soc. of Am. Memoir 67, 1296 p., illus., maps, \$12.50.

THE TREE OF MATHEMATICS—Glenn James, Ed.—Digest Press, 403 p., illus., \$5.50. Reference book for anyone working in mathematics or related fields. Contributions by well-known mathematicians.

THE WAY OF THE WEATHER—Jerome Spar—Creative Educ. in cooperation with the Am. Mus. of Natural Hist., 224 p., illus., \$4.95. Large format, many photographs and charts in color with clear text.

THE WONDER OF WATER—Soil Conservation Society of America, 15 p., illus., paper, 20¢. The story of water conservation in comic-book style.

THE WORLD BENEATH THE WAVES—Gilbert Doukan, translated by A. and R. M. Case—De Graff, 356 p., illus., \$6. Reports on the state of the world beneath the surface of the water which covers four-fifths of the world's surface.

THE WORLD IN SPACE: The Story of the International Geophysical Year—Alexander Marshack—Nelson, 176 p., illus., \$4.95. A popularly written history of geophysics with reference to the tasks of the IGY.

THE WORLD OF THE INCA—Bertrand Flornoy, translated by Winifred Bradford—Doubleday, 231 p., illus., paper, 95¢. Goes deep into the origins of Inca civilization.

Science News Letter, February 15, 1958

GEOPHYSICS

Satellite Recovery Seen

► RECOVERING artificial satellites with their valuable records of conditions at the fringes of earth's atmosphere was foreseen as one result of studies in the new science of "magneto-aerodynamics."

Dr. William R. Sears, director of the graduate school of engineering at Cornell University, told a National Academy of Sciences meeting in Washington how research in this science may provide means for the safe return of Explorer and other space vehicles. Further research in this field may also lead to a tremendous increase in the thrust of conventional rocket motors.

Studies in magneto-aerodynamics deal with the partial ionization of air that occurs when objects pass through it at extremely high speeds, particularly the re-entry of rockets and satellites into the earth's atmosphere. As friction and compression heat the air ahead of the object to very high temperatures, the atoms composing air release free electrons, thus making the air electrically conducting.

Research at Cornell, Dr. Sears reported, shows this conductivity can be further increased by "seeding" the air near a high-speed body with small amounts of substances that ionize easily, such as sodium or potassium. At speeds 10 to 12 times that of sound, which is about 1,000 feet per second at sea level, air conductivity several times

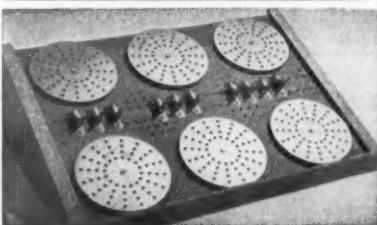
better than salt water can be thus obtained, Richard J. Rosa has calculated.

"If this technique can be worked out, and if magnetic field strengths comparable to those of permanent magnets can be provided in flight," Dr. Sears said, "electric currents will be set up by the motion of the air, and significant forces can be applied directly to the airstream."

For a satellite re-entering the earth's atmosphere at high speed, the electromagnetic relationships will resemble those of an electric generator. The hot, seeded air, being electrically conductive, takes the place of windings of the generator armature, while the magnetic field emanating from the satellite will supplant the generator's fixed field. As the satellite plunges into the atmosphere the moving of this hot-air "armature" across the satellite's magnetic field will generate an electric current, thus slowing down air flowing past it.

Concerning the possibilities of increasing a rocket's thrust, Dr. Sears said, "this will require the use of electric fields as well as magnetic, for now the analogy is not with a generator but an electric motor." He said the combination of a current and a magnetic field would give rise to a force that can be directed to accelerate the airflow rearward from the rocket.

Science News Letter, February 15, 1958



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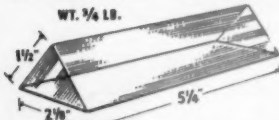
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Questions

PHYSICS—Why is the psi meson also known as a "cascade particle"? p. 99.

NEUROLOGY—How is it possible that someone who sings tenor may speak with a deep voice? p. 104.

BIOPHYSICS—What effects did artificially high gravity have on mice? p. 103.

SURGERY—What are two methods that have been used to try to give someone with an artificial hand the ability to feel? p. 106.

Photographs: Cover, Smithsonian Institution; p. 99, University of California; p. 101, U. S. Army; p. 103, University of Wisconsin; p. 106, Walter Reed Army Medical Center; p. 112, Trimble, Inc.

GENERAL SCIENCE

Richer and Healthier Americans Seen in 1983

➤ TWENTY-FIVE years hence Americans will be richer, physically and mentally healthier, and more numerous, William Benton, former U. S. Senator, told 200 scientists, educators and industrialists conferring in New Haven, Conn.

In order to bring this about and assure the future, he advised scientists to cultivate and instruct politicians in order to be sure that there is adequate science education and provision for basic, as well as applied research. He urged scientists to concentrate on the politicians rather than try to win greater public understanding for science by appealing to intellectuals and the general public.

If we make opportunity for learning as freely available to those with talent and ability as the water we drink, Mr. Benton said, we return to an historic American assumption that our natural resources reside in the capacities and aspirations of the coming generations.

If our national safety and continued progress is assured, Mr. Benton sees in 1983 family income at an average level of \$15,300 a year, two and one-half times the present level. Half the people now being killed or maimed by the three main causes of disability, heart and circulation disorders, cancer and mental disorders, will avoid them and survive in good health. There will be a population of 250,000,000 Americans, at least 100,000 of whom alive in 1983 will reach the age of 100.

Science News Letter, February 15, 1958

Do You Know?

It takes about 50,000,000 years for heat to get from the core of the sun to the surface.

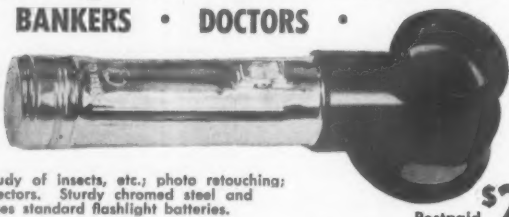
An electronic altimeter, accurate to within 40 feet at 60,000 feet altitude, has been developed.

The cranberry produces from four to 20 million blossoms per acre.

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Here's an unusual tool, even for us the tiny Mini-Bee Block & Tackle. It weighs only 13 ozs., yet is so powerful it lifts up to 1000 lbs. easily! Because of its great strength, small size, complete portability—this block and tackle has many uses. In your car for emergencies, for home, factory, farm for loading heavy articles. For sportsmen, loading, deer, boats, etc. For anyone who has to do heavy lifting! Fine engineering throughout, best grade aluminum, steel axles, pre-lubricated for life. Holds two lifting slings, at top and bottom, with heavy welded steel rings. Slings can be doubled for extra strength. Complete with 70 ft. nylon cord, 5 to 1 ratio—1000 lb. test. Carrying bag. Instructions—ppd. **\$9.95**

ALSO AVAILABLE—Tiny Babe—lifts up to 2000 lbs.! With 100 ft. nylon cord, 2-1 ratio—2000 lb. test—15 oz. wgt. Twice as powerful as \$9.95 model—only **\$12.95** ppd.

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Made from the best quality tool steel, to fit the exacting requirements of mechanics, watch and jewelry craftsmen, hobbyists. Attractive kit contains the following: 5 1/2" long needle and warding files with high test cutting qualities: round, flat, knife, square, triangular. In all textures: fine, medium, coarse, fine, medium, medium coarse, coarse. Comes with polished wood handle and new type steel grip chuk.

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Emergency FLARE KIT

It may save your life and the lives of loved ones if stalled on the road for any reason. Kit contains 3 FULL BRIGHT, easy lighting, windproof, rainproof flares plus extinguisher. Brilliant flares can be seen for several hundred feet—can be reused time and again. Also ideal as a source of warmth for winter play; for lighting camp fires and barbecues; a source of emergency light or cooking gas; light through dark areas. Safe and easy to use. Compact.



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These powerful permanent magnetized magnets—each the size of a jelly bean—lifts over 1/2 pound! Sewn into net holders, towels, shower curtains—makes them securely cling to steel. Holds items on dashboard, metal files, demonstration or bulletin boards. Recover items from hard-to-get-at places. Pulls through glass, wood, paper, leather, plastic—anything but iron. All 10 rustproof magnets—**\$1.00** ppd.

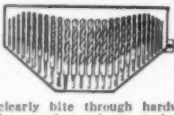


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Send \$2.50 for each set ordered.

Chrome Vanadium 29 Pc. DRILL SET

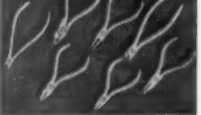


Specially made for speed drilling. In sturdy plastic tool roll. Finest alloy steel drills hardened and precision ground to the sharpest, longest lasting cutting edge obtainable; will easily and speedily drill through iron and toughest steels. Unconditionally guaranteed for thousands of drillings. Full jobber length. Sizes by 64th from 1/16" to 3/4". There are only a limited quantity of sets available at this low price, so hurry! Also available with Turned Down Shanks to fit all 1/4" drills. In individual pocket roll.

\$6.49 ppd.

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FINEST QUALITY Imported Precision Pliers



Flat Nose, Round Nose, Diagonal, End Cutting, Nippers, 1 Side Flat—1 Side Round, Snipe Combination for Jewelers, Optical Workers, Hobbyists. These European instruments are of deep-forged, heat-treated high quality tool steel, fabricated to most exacting specifications. All-over ground, polished to smooth hard surfaces. Smooth working joints with right tension. Jaws meet perfectly to securely hold the most delicate objects in hard-to-reach corners and angles. Each plier is 4" long.

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Top quality high test Chrome Vanadium Drills designed for speed drilling through toughest steels, woods, plastic, iron and aluminum. Precision ground, long-lasting cutting edges.

Guaranteed to give years of satisfaction. A full 60 pc. set, Nos. 1 through 60. A \$14.95 value

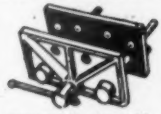
NOW ONLY \$5.40 plus 25¢ pp. & hdlg.

Same set above with Hook Index Container—Only **\$6.65** pp. & hdlg.

Also available 61-80 set of high quality drills in plastic kit with marked pocket for each drill—ONLY **\$2.50** plus 50¢ pp. & hdlg.

Wood Working

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For home and shop... amazingly perfect, solidly constructed vise with full 5 1/2" wide jaws that open to 5". Feature smooth-working polished steel bars that glide easily back and forth, yet firmly and securely lock work for even the finest of precision crafting. Attractive red enamel body.

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1 1/8" dia., 375 lb. test, per ft. **26¢**
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In 50, 100, 200, 300, 400, 500 ft. & over lengths

NYLON BRAIDED LINE

1/4" dia., 1000 lb. test, olive drab, per ft. **36¢**
In 30, 40 & 50 ft. lengths only

NYLON ROPE

5/16" dia., 1000 lb. test, per foot **12¢**
3/8" dia., 2700 lb. test, per foot **17¢**
7/16" dia., 3800 lb. test, per foot **30¢**
All in any length up to 1200 feet.

NYLON FISH LINE

Proven best by experienced fishermen. Heat stretched. Will not kink, twist or unravel. 25 lb. test, 300 ft. Reg. \$1 per spool **NOW 50¢**

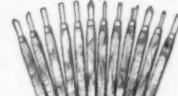
NYLON WEB STRAPS

with sturdy steel buckle

Perfect for passenger safety belts, luggage straps, car towlines, car carrying straps, boat trailer straps, etc. The heavy equipment and machinery with greater ease and safety at far less cost. Just the thing for the garage or workshop.

1" wide, 5000 lb. test, per foot **10¢**
1 1/2" wide, 6000 lb. test, per foot **16¢**
In 5, 6, 8, 10, 12 foot lengths

Surgical Steel — Hand Ground



Set of 12 CARVING KNIVES

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The sharpest, keenest ground, surgical steel blades we have ever seen—sharp enough to split a human hair in two! 12 different shapes and edges can do every job of wood carving, model making, linoleum cutting, sculpting and whittling. Magnificent! Each blade has a 4 1/2" long hardwood handle for easy gripping. Heavy duty blade is firmly attached by means of a brass ferrule to insure longer, continued rugged use. Each surgical steel blade precision hand ground to easily and quickly notch and cut any shape you wish. A sensational all-purpose set, well worth \$3.95.

Lifetime Grit HANDY SANDER



Tungsten Carbide Grit Braided on Steel

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✿ **LABORATORY PORCELAINWARE** is described as sintered aluminum oxide chemically pure without additions. The material does not soften, but has a well-defined melting point of 2,050 degrees centigrade. At high temperatures and pressures, the absorption is said to be nil.

Science News Letter, February 15, 1958

✿ **BARBECUE GRILLE** is designed for installation in brick or other masonry construction. It is made of heavy gauge steel with an angle iron type frame. The outside finish is black wrinkle enamel, with stainless steel and chrome trim.

Science News Letter, February 15, 1958

✿ **MEDICAL TOOL SHARPENER** for scissors, knives and scalers is made of tungsten carbide. The sharpener, five inches long, has five cutting edges for various shapes and sizes of instruments and a rounded burnishing edge.

Science News Letter, February 15, 1958

✿ **PLAY YARD** for infants and toddlers, shown in the photograph, is lightweight and portable. Frame and legs are made of aluminum tubing. The floor braces are of steel supporting a hard board floor. Knitted



nylon sides can be dropped. Plastic covers the top rails and the filled, reversible floor pad. The play yard measures 40 by 40 inches square.

Science News Letter, February 15, 1958

✿ **SPOOL LOOM** can be used by young and old for making scatter rugs, coaster sets, table place mats or chair seats. Strips of any

cloth are wound on the loom, bound through slots and joined.

Science News Letter, February 15, 1958

✿ **RADIO-TELEPHONE** for small boats is transistorized. The set will receive continuously for a year on a standard 12-volt battery. The four-channel 20-watt set transmits 50 to 75 miles, weighs 10 pounds and measures 5 by 10 by 11 inches.

Science News Letter, February 15, 1958

✿ **GARDEN MULCH** made of black polyethylene plastic is said to help plants grow faster and eliminate some weeding, watering and cultivating. The mulch comes in 20-foot lengths, 36 inches wide. Under normal conditions, it can be used for more than one growing season.

Science News Letter, February 15, 1958

✿ **RADIOLOGICAL SURVEY METER** is designed for use in industrial laboratories, hospitals and reactor installations to measure low-level radiation. The transistorized meter, weighing four and one-half pounds, is powered by five standard 1.5 volt flashlight cells. It operates for 250 consecutive hours on one set of batteries.

Science News Letter, February 15, 1958



Nature Ramblings



By HORACE LOFTIN

► **THE COLD**, fog-shrouded Pribilof Islands of the Bering Sea off Alaska are a desert of ice and snow now. You would have to look hard to find a living creature, save a few hardy sea birds.

But spring will turn this desert into a metropolis.

With the changing of the seasons, bull fur seals will come in from winter quarters south of the Aleutians or the Gulf of Alaska, each to establish by brute strength a personal domain for his coming harem. The weaker males are doomed to bachelorhood. Meanwhile, the females and their young born last year leave their winter resort, which may be as far south as southern California, for the long swim to the Pribilof Islands.

At the breeding grounds, the females will attach themselves to likely looking mates by moving to their territories. Old bull fur seals may have as many as 40 cows in their

Fin-Footed Mammals



harems, and woe betide the bachelor bull that tries to enter these seraglios!

The young will be born shortly after the females arrive, and mating occurs soon afterward. The bulls will not leave their territory during the entire breeding season, doing without food for three months. The cows, however, may go and come as they please, bringing food back to the rookery for their pups.

The Pribilof fur seal population is under the care of the U. S. Fish and Wildlife

Service, which carefully regulates the harvesting of skins. Some 65,000 skins are taken annually under the watchful eyes of wildlife experts. From a low of 132,000 seals in 1910, before the Government stepped in to protect the much-hunted species, there are now more than 1,500,000 fur seals in the herd!

The fur seals are members of the order of fin-footed mammals or Pinnipedia. While very much like the carnivores, all of the pinnipeds have the fore and hind limbs modified into flippers. The teeth are specialized for catching and feeding on fish and other marine creatures. The group shows a high order of intelligence.

The walrus make up a separate family in the order of fin-footed mammals. They are characterized by their great size and the huge tusks, or canine teeth, which protrude from the upper jaw. These tusks may reach 30 inches or more in length. A bull walrus may exceed 10 feet in length and weigh more than a ton!

Science News Letter, February 15, 1958

